Feasibility of transplanting *Rabi* maize (*Zea mays* L.) varieties to varying age of seedling under middle Gujarat conditions

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**Abstract**

The experiment was conducted at the College Agronomy Farm, Anand Agriculture University, Anand during 2015-2016 to study the feasibility of transplanting maize varieties to varying age of seedling. The treatment included in the experiment were two varieties viz. Gujarat Maize 3 (GM 3) and High Quality Protein Maize (HQPM 1) and five age of seedling viz. 14, 21, 28, 35, and 42 day old. Results revealed that variety V2 (HQPM 1) recorded significantly higher plant establishment per cent (96.38), plant height (11.20 cm) at 20 DATP, number of leaves plant-1 (18.75) at harvest, number of grains cob-1 (352), cob girth (11.23 cm), cob length (13.15 cm) as well as grain and straw yields. Significant variations in plant establishment per cent, plant height at 20 DATP, number of leaves plant-1 at 40 DATP, number of grains cob-1, grain and straw yield was observed due to different varieties and age of seedling. Among all the treatment combinations, treatment combination V2A2 (HQPM 1 + Three weeks old seedling) recorded significantly higher plant establishment (97.50 %), number of grains cob-1 (443), grain yield (3405 kg ha-1) and straw yield (4887 kg ha-1) as compared to rest of the treatment combinations.

**Keywords:** Transplanted maize, yield, variety, age of seedling

1. **Introduction**

Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions and in production next to wheat and rice in the world. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. Ideal sowing time of *Rabi* maize lies in last week of October to mid-November in Gujarat but during winters where fields are not remain vacant in time (till November) due to existing of *kharif* crop. Delayed germination and plant growth receives a major setback due to late sowing of maize. Hence, grain yield reduces due to late sowing as the crop experiences high temperature with the advancement of growth which reduces the duration for grain filling and dry matter accumulation resulting in small grain size (Biswas et al. 2009) [7]. Reduction in the yield of maize can be compensated by transplantation technique. Badran (2001) [4] stated that under late sowing conditions, transplanting of maize may be a viable alternative to direct sowing. Sowing of maize is a traditional practice whereas, transplantation of maize is a recent technique. Transplantation technique in maize helps farmers to harvest a third crop in areas where none would have been possible because of late harvest of *Rabi* maize; as maize transplantation shortened the crop period of 8-10 days (Basu and Sharma, 2003) [5]. If maize seedlings are raised in nursery in the month of November and transplanted after harvesting of rice, the adverse effect of low temperature (delayed sowing) can be minimized. Therefore, transplanting of seedling may be an important area of study for maize cultivation considering the field duration and early plant establishment in Gujarat. Unfortunately, sizeable amount of works have not been reported on transplanted maize in India whereas in Gujarat, so far no any work was carried out as individual factor or in conjunction with other factor in transplanting of maize. Keeping all these facts in view the present field experiment was carried out to evaluate the performance of transplanted maize under midlands and to standardize an optimum age of seedling under middle Gujarat conditions.

2. **Material Method**

A field experiment was conducted during *Rabi* season of the year 2015-16 at College Agronomy Farm, Anand Agricultural University, Anand. The soil of the experiment field was loamy sand (Goradu) having 8.35 pH, 0.43 organic carbon, 217.42 kg/ha, available N, 45.72 kg/ha, available P2O5 and 256.69 kg/ha available K2O. Average annual rainfall of 864.5 mm, which is realized entirely from the south-west monsoon currents.
The experiment was consisted of 10 treatment combinations with two factors studied under factorial randomized block design with four replications. The factor one with two varieties (V1: GM 3 and V2: HQPM 1) and second factor with five different age of seedling (A1: two weeks old seedling, A2: three weeks old seedling, A3: four weeks old seedling, A4: five weeks old seedling and A5: six weeks old seedling). The seedlings of both the variety were raised in the nursery. The plot was kept ready through tractor drawn cultivator for preparing nursery beds. The five beds of 4 m long and 2.5 m wide were prepared. 500 kg of FYM applied to the beds and beds were leveled thoroughly. The seeds were sown in line keeping the 20 cm apart and covered with soil. The nursery was raised on different dates 09/11/2015, 16/11/2015, 23/11/2015, 30/11/2015 and 07/12/2015 as per the requirement of age of seedling i.e. two weeks, three weeks, four weeks, five weeks and six weeks old seedlings. The seedling of both the varieties GM 3 and HQPM 1 of different age were used for transplanting as per the treatments. The seedlings were transplanted keeping the row to row distance of 60 cm and plant to plant 20 cm in each plot. The first light irrigation was given to the crop before transplanting for better establishment. One healthy seedling was transplanted at each hill. The maize crop was fertilized with recommended dose of fertilizer (120:60:00 kg N, P2O5 and 20 kg ZnSO4 ha−1). Total quantity of phosphorus, zinc and 50 per cent of the nitrogen was applied in the soil at the time of transplanting. At 25-30 DATP, top dressed 25 per cent of the nitrogen and remaining 25 per cent nitrogen top dressed at 40-45 DATP. The N was supplied through urea and P was supplied through DAP while zinc was supplied through Zinc sulphate. In general, different weather parameters were favourable for plant growth during experimental period. The other package of practices was adopted to raise the crop as per the recommendations. In order to represent the plot five plants from each plot selected and labelled and all biometric observations was taken from selected plants. Data on various observations during the experiment period was statistically analysed as per the standard procedure developed by Cochran and Cox (1957) [9].

3. Results and Discussion

3.1 Effect of varieties

The results presented in Table 1 indicated that variety V2 (HQPM 1) recorded significantly the highest plant establishment per cent (96.38). This observation suggests that age of seedling may be an important factor in establishment of plant in different varieties. The higher per cent establishment under HQPM-1 variety might be due to below-ground characteristics of plant root system that differentiate the establishment per cent. Different varieties showed their significant influence on plant height measured at harvest whereas, it was non-significant when plant height measured at 20 and 40 DATP. Significantly higher plant height of 111.20 cm was recorded under treatment V2 (HQPM 1) than that of treatment V1 (GM 3) at harvest. Similar line of results reported by Anil and Sezer (2003) [10] they observed that there were significant differences between the cultivars in terms of plant height of sweet corn transplant. Further, number of leaves plant−1 counted at advancement of crop growth stage was unaffected significantly due to varietal treatment at 20 DATP while significant differences were observed at 40 DATP and at harvest. At 40 DATP, both the varietal treatment differed statistically with each other wherein, significantly the highest and the lowest number of leaves plant−1 was recorded under treatment V2 (HQPM 1) and V1 (GM 3), respectively. More or less similar line of results was also noticed at harvest.

With regards to yield attributes and yields, variety V2 (HQPM 1) recorded significantly the highest number of grains cob−1 (352), cob girth (11.23 cm), cob length (13.15 cm), grain and straw yields. Anil and Sezer (2003) [11] also observed that there were significant differences between the cultivars in terms of number of grains and ear weight of transplanted sweet corn. Biswas (2008) [9] was also observed differences in cob length due to different maize varieties. Similar line of results was also reported by Mapfumo et al. (2007) [12] in pearl millet wherein, they noticed that variety PMV3 out yielded than PMV2.

3.2 Effect of age of seedling

Among all the age of seedling, treatment A2 (Three weeks old seedling) was recorded significantly maximum plant establishment per cent of 96.88 at 20 DATP as compared to treatment A5 (Six weeks old seedling). While significantly the lowest plant establishment per cent of 83.13 was observed under treatment A5 (Six weeks old seedling) at 20 DATP. Murungu et al. (2006) [13] also observed that 20 day old transplants having a better plant stand than that of recorded under 30 and 40 day old transplants in pearl millet. Results reported in Table 1 revealed that increasing age of seedling there was linearly increased the plant height of maize from treatment A1 to A5 at 20 DATP wherein, treatment A5 (Six weeks old seedling) was recorded significantly maximum plant height of 36.76 and 48.53 cm at 20 and 40 DATP, respectively. The results are accordance with the results of Kumar et al. (2014) [11]. They reported that transplantation of 7 weeks old seedling attained maximum plant height at 30 and 60 days after transplanting but 90 DAT the plant height of 5 weeks old transplanted seedling was recorded maximum. Whereas, significantly the lowest plant height was measured in treatment A1 at 20 and 40 DATP, respectively. Agbaje and Olofintoye (2002) [6] also observed shorter plant height in transplant of 8 weeks old seedling of sorghum. This could be due to transplanting shock experienced during uprooting from the nursery. This may be attributed to the ability of plants to easily regenerate new roots after transplanting and resume active nutrient uptake. At harvest, treatment A2 (Three weeks old seedling) recorded the highest plant height of 127.79 cm while, treatment A5 (Six weeks old seedling) recorded the lowest plant height of 85.71 cm. Age of seedling showed unequivocally significant differences in number of leaves plant−1 at 40 DATP and at harvest but fail to exert their significant influence on number of leaves plant−1 at initial duration i.e. at 20 DATP. Treatment A5 (Five weeks old seedling) recorded significantly higher number of leaves plant−1 (9.88) as compared to rest of the treatments except treatment A2 at 40 DATP. At harvest, treatment A5 (Six weeks old seedling) and A4 (Four weeks old seedling) recorded significantly the highest number of leaves plant−1 (20.75) while the lowest value (12.13) was noticed under treatment A3 (Six weeks old seedling). Dale and Drennan (1997) [9] also observed that among all the transplanted age of seedling, 45 day old transplants formed fewer leaves than the younger transplants. The lower leaves under 45 day old transplant might be due to older transplants were long and thin and had almost grown out before planting, so they experienced particularly severe transplanting shock hence, plants are
unable to perform well with respect to producing the higher number of leaves.

Treatment A2 (Three weeks old seedling) recorded significantly maximum number of cob length, cob girth and grains cob⁻¹ while treatment A6 (Six weeks old seedling) recorded significantly minimum number of cob length, cob girth and grains cob⁻¹. The results are in accordance with the results of Kumar et al. (2014) [10] wherein, they reported that the enhanced vegetative growth in terms of leaf area index, dry matter accumulation and root volume resulted in more grains per cob. The result indicated that increasing the age of seedling linearly decrease the grain yield and straw yield of maize from treatment A2 (Three weeks old seedling) to A5 (Six weeks old seedling) wherein, treatment A2 (Three weeks old seedling) showed supremacy by recording significantly the highest grain yield (2963 kg ha⁻¹). This might be due to abrupt switch off from growth phase to reproductive phase and more reduction in crop duration as compared to others. Higher straw yield under treatment A2 (three weeks old seedling) can be explained by the fact that plant transplanted with lesser age of seedling resulted in more number of leaves and root biomass which contributed towards increased source-sink relationship within the plant which increased dry matter accumulation by plant and there by higher straw yield.

### 3.3 Interaction effect

The interaction effect between different varieties and age of seedling brought significant variations in number of grains cob⁻¹ (Table 2), grain and straw yield (Table 3). Number of grains cob⁻¹ was significantly higher under V₂A₂ (HQPM 1 + Three weeks old seedling). Significantly higher grain and straw yield was recorded under treatment combination V₂A₂ (HQPM 1 + Three weeks old seedling) and found to be significantly superior over rest of treatment combinations.

Higher yield under V₂ variety showed the response of age of seedling with this variety. The lower yield under V₁A₅ combination may be attributed to consequently yield attributes were adversely affected and ultimately produced lesser crop yield over 4, 5 and 6 weeks transplanted maize. The results confirm the findings of Andreas and Ransom (2002) [2] on winter transplanted maize.

### Conclusion

From the above findings, it is concluded that higher grain yield, net realization and benefit cost ratio (BCR) of Rabi maize could be achieved with transplanting of maize varieties either HQPM 1 or GM 3 with three weeks old seedling under middle Gujarat conditions.
References